

# Solar ENA Imaging Coronagraph Project

Completed Technology Project (2011 - 2012)



## Project Introduction

Observations of energetic neutral atoms (ENAs) provide the only way to observe solar energetic particles (SEPs) where they are accelerated. The one observation of solar ENAs to date had low sensitivity, a high energy threshold, and no imaging information. The Solar Energetic Neutral-atom Imaging Coronagraph (SENIC) instrument concept combines large detector area, a low energy threshold, and high angular resolution. The key design challenge for this concept was to minimize the level of stray light illuminating the detectors.

Measurements of energetic neutral atoms (ENAs) are a new tool to improve our understanding of energy release and particle acceleration in solar eruptive events. Due to limitations of past observations, even the most basic questions remain unanswered about the acceleration of solar energetic particles (SEPs) by shocks driven by coronal mass ejections (CMEs). ENAs provide the only way to observe SEPs where they are accelerated. The one observation of solar ENAs to date had low sensitivity, a high energy threshold, and no imaging information. The Solar Energetic Neutral-atom Imaging Coronagraph (SENIC) instrument concept is designed to observe ENAs from  $< \sim 20$  keV to a few hundred keV with a spectral resolution as good as 1 keV and image them from  $2 R_{\text{sun}}$  to  $40 R_{\text{sun}}$  with a spatial resolution of  $0.1 R_{\text{sun}}$ . Since ENAs cannot be imaged with focusing optics, this concept uses an indirect imaging technique similar to the one successfully used on RHESSI. Thus, the SENIC instrument concept combines large detector area, a low energy threshold, and high angular resolution.

## Anticipated Benefits

Future space-based instrument for solar ENA imaging with high angular resolution and large area Well-suited to be the primary instrument for an exploration mission. Also, could be part of an instrument suite.

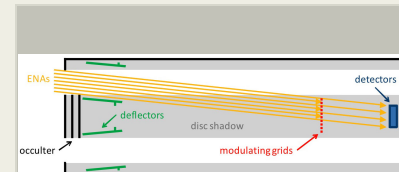


Illustration of the notional instrument concept. ENAs propagate undeflected by an electrostatic field, then pass through the modulating grids, to ultimately reach the detectors.

## Solar ENA Imaging Coronagraph

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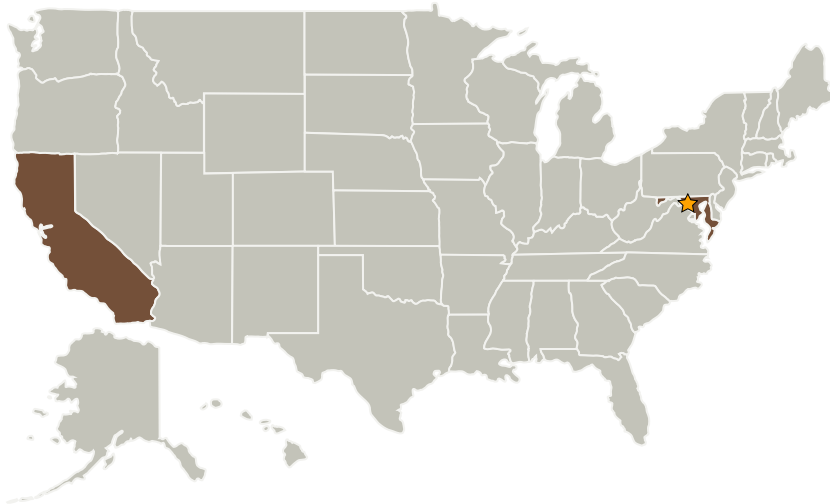
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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
University of California-Berkeley(Berkeley)	Supporting Organization	Academia	Berkeley, California

## Primary U.S. Work Locations

California	Maryland
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## Organizational Responsibility

**Responsible Mission Directorate:**

Mission Support Directorate (MSD)

**Lead Center / Facility:**

Goddard Space Flight Center (GSFC)

**Responsible Program:**

Center Independent Research &amp; Development: GSFC IRAD

## Project Management

**Program Manager:**

Peter M Hughes

**Project Manager:**

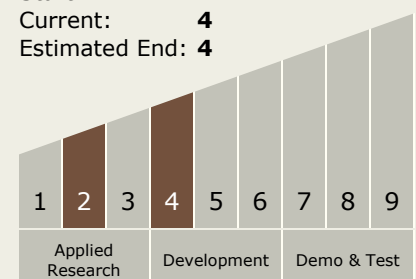
Nikolaos Paschalidis

**Principal Investigator:**

Albert Y Shih

## Technology Maturity (TRL)

Start: 2  
 Current: 4  
 Estimated End: 4

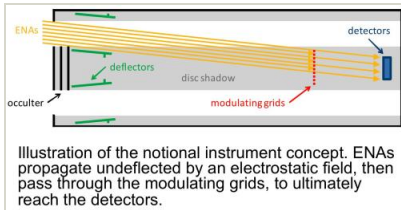


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## Images



### Solar ENA Imaging Coronagraph

Solar ENA Imaging Coronagraph  
(<https://techport.nasa.gov/image/2984>)

### Project Website:

<http://sciences.gsfc.nasa.gov/sed/>

## Technology Areas

### Primary:

- TX08 Sensors and Instruments
  - └ TX08.2 Observatories
    - └ TX08.2.1 Mirror Systems